

11/10/15 "Intelligence plus character, that is the true goal of education." - Martin Luther King Jr.

HW: Text page 16 #1-9 odd 10-14

AIM: How do we solve Absolute Value equations?

Warm Up:

1) Solve

$$\begin{aligned}
 3\sqrt{x-2} - 2\sqrt{x+8} &= 0 \\
 +2\sqrt{x+8} + 2\sqrt{x+8} \\
 (3\sqrt{x-2})^2 &= (2\sqrt{x+8})^2 \\
 9(x-2) &= 4(x+8) \\
 9x - 18 &= 4x + 32 \\
 -4x - 18 &= -4x + 32 \\
 \frac{5x}{5} &= \frac{50}{5} \\
 \boxed{x=10} &\checkmark
 \end{aligned}$$

2) Evaluate

$$\begin{aligned}
 |7| &= 7 \\
 |-3| &= 3 \\
 |-\frac{1}{2}| &= \frac{1}{2}
 \end{aligned}$$

To solve an absolute value equation, isolate the absolute value on one side of the equal sign, and establish two cases:

Ex: $|a| = b$

Case 1: $|a| = b$ set $a = b$

Case 2: $|a| = b$ set $a = -b$

Both cases are "derived" equations which are not necessarily the same as the original equation, therefore we need to **ALWAYS CHECK THE SOLUTIONS!**

Remember: Absolute value is always positive (or zero). An equation such as $|x-4| = -6$ is never true. It has NO solution. The answer is the empty set \emptyset .

Steps: (Solving Absolute Value equations)

- 1) Isolate the absolute value
- 2) Set up the 2 cases (+) one (-)
- 3) Solve each case
- 4) Check

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1) **Case 1** $|x-10| = 6$ **Case 2**

$$\begin{aligned}
 x-10 &= 6 \\
 +10 +10 \\
 \boxed{x=16} &\checkmark
 \end{aligned}$$

$$\begin{aligned}
 x-10 &= -6 \\
 +10 +10 \\
 \boxed{x=4} &\checkmark
 \end{aligned}$$

2) $|4x+6|+8=3$

$$\begin{aligned}
 -8 -8 \\
 |4x+6| &= -5
 \end{aligned}$$

Case 1

$$\begin{aligned}
 4x+6 &= -5 \\
 -6 -6 \\
 4x &= -11 \\
 \frac{4x}{4} &= \frac{-11}{4} \\
 \boxed{x = -\frac{11}{4}} &\checkmark
 \end{aligned}$$

Case 2

$$\begin{aligned}
 4x+6 &= 5 \\
 -6 -6 \\
 4x &= -1 \\
 \frac{4x}{4} &= \frac{-1}{4} \\
 \boxed{x = -\frac{1}{4}} &\checkmark
 \end{aligned}$$

Check:

$$\begin{aligned}
 |4(-\frac{11}{4})+6|+8 &= 3 \\
 |-11+6|+8 &= 3 \\
 |-5|+8 &= 3 \\
 5+8 &= 3 \\
 13 &= 3 \\
 \text{No!}
 \end{aligned}$$

$$\begin{aligned}
 |4(-\frac{1}{4})+6|+8 &= 3 \\
 |-1+6|+8 &= 3 \\
 |5|+8 &= 3 \\
 5+8 &= 3 \\
 13 &= 3 \\
 \text{No!}
 \end{aligned}$$

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3) $|3x+2| = 4x+5$

Case 1

$$\begin{aligned}
 3x+2 &= 4x+5 \\
 -2 -2 \\
 3x &= 4x+3 \\
 -4x -4x \\
 -x &= 3 \\
 -1 -1 \\
 \boxed{x = -3} &\text{reject}
 \end{aligned}$$

Case 2

$$\begin{aligned}
 3x+2 &= -4x-5 \\
 +5 +5 \\
 3x+7 &= -4x \\
 -3x -3x \\
 7 &= -7x \\
 -7 -7 \\
 \boxed{x = -1} &\checkmark
 \end{aligned}$$

4) $5|c-2| = 30$

$$\begin{aligned}
 \frac{5}{5} \frac{|c-2|}{5} &= \frac{30}{5} \\
 |c-2| &= 6
 \end{aligned}$$

Case 1

$$\begin{aligned}
 c-2 &= 6 \\
 +2 +2 \\
 \boxed{c=8} &\checkmark
 \end{aligned}$$

Case 2

$$\begin{aligned}
 c-2 &= -6 \\
 +2 +2 \\
 \boxed{c=-4} &\checkmark
 \end{aligned}$$

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